

A Structural VAR Model of Exchange Rate Market Pressure: The Case of Indonesia

Lestano¹

Faculty of Economics, Atma Jaya Catholic University, Jakarta

ABSTRACT

This paper examines how exchange rate market pressure (*EMP*) response to its determinant shocks for the case of Indonesia using quarterly data for the period 1981:Q1–2004:Q4. We translate theoretical model of exchange rate market pressure into empirical model and test the model by means of a Structural VAR methodology. We find some evidence of a positive relationship between *EMP* and domestic credit. However, output growth also plays a role in the determination of *EMP*. In addition, there is evidence that output growth and money multiplier affected *EMP* negatively.

Keywords : exchange rate market pressure, structural VAR, Indonesia

JEL codes: C32, F31, F41

1. INTRODUCTION

The need to evaluate the magnitude of exchange rate market pressure (*EMP*) and to explain the development of the exchange rate and the actions of the national monetary authority under various exchange rate regimes remains as long as exchangeable currencies and the international foreign exchange market exist. Various theoretical models of *EMP* have been extended from early model initiated by Girton and Roper (1977). The model is used to measure *EMP* and to analyze the link between *EMP* and its determinants, such as monetary policy measured by domestic interest rates or growth of domestic credit; and real sector, for instance, economic growth. In the literature of currency crisis, *EMP* is constructed as an index pioneered by Eichengreen, Rose, and Wyplosz (1995). *EMP* index is employed to date currency crisis events. Their *EMP* index is a weighted sum of exchange rate changes, international reserve changes and interest rate changes. Speculative attacks on domestic exchange rate can be unsuccessful if money authority raise interest rate and deplete international reserve. Date of currency crisis is identified if *EMP* index hit constructed *ad-hoc* threshold. Lestano and Jacobs (2007) provide a comparative study on various type of *EMP* index employed to date currency crisis events.

¹ Correspondence to: Faculty of Economics, Atma Jaya Catholic University, Jenderal Sudirman 51, Jakarta 12930, Indonesia. Tel.: +62 (0)21 5708815. Fax: +62 (0)21 5708814. Email: lestano@atmajaya.ac.id

Another group of study analyzes the relationship between *EMP*, monetary policy, and economic growth. Tanner (2001), for instance, employs a VAR (Vector Autoregression) technique to uncover the interrelations between *EMP* and monetary policy, measured in changes in domestic credit and the interest rate differential, for the cases of emerging markets in 1990-1998. He concludes that a contractionary monetary policy eases *EMP*, in spite of which an increase in *EMP* translates into higher credit growth in most cases. Gochoco-Bautista and Bautista (2005) investigate the relationships between monetary policy and *EMP* for the Philippines, and test for the existence of different results before and after the currency crises of 1997-1998. They conclude that the responses of monetary policy to *EMP* were more contractionary in the crisis period; also, that the effect of interest rates on *EMP* was negative in the tranquil period, but positive in the crisis period. Finally, recent study by Garcia and Malet (2007) include real sector, that is, economic growth, besides monetary policy, in explaining behavior of *EMP*. Using sample periods between 1993-2004 for Argentina, they find some evidence of a positive and double-direction relationship between *EMP* and domestic credit. Nevertheless, output growth also played a role in the determination of *EMP*, even more than domestic credit or interest rates. In addition, there is some evidence that *EMP* affected growth negatively.

This paper examines the relationship between *EMP*, monetary policy, and real sector measured by output growth for the case of Indonesia over the period 1981-2004. Using modified version of the theoretical model of Gorton and Roper (1977), we identify an empirical model by means of a Structural Vector Autoregression (SVAR) model. The SVAR model allows for a theoretical structure that identifies the structural shocks from observed residuals. We analyze three types of shocks: a domestic credit growth, a money multiplier, and an output growth shock. We assume the three types of shocks to be independent and investigate to what extent these shocks affect *EMP*. Our overall conclusion is that the Indonesia's exchange market pressure is affected by monetary policy and real sector shocks as expected by the theoretical model. We find that shocks to the domestic credit growth variable are important for explaining *EMP* and the estimates suggest that shocks to domestic credit growth affect *EMP* positively. In the case of output growth shock to *EMP*, there is evidence of worsening real sector escalate *EMP*. Finally, our result confirms that in some periods response of *EMP* to money multiplier shock is line with domestic credit shock.

The remainder of this paper is structured as follows. First, we explain the theoretical model of exchange rate market pressure in Section 2. We show how exchange rate market pressure related with monetary policy and economic growth. Next, we translate the theoretical model into an empirical VAR-structure in Section 3. Afterward Section 4 discusses the sources and properties of the data. We present our major findings in Section 5. Section 6 concludes.

2. THEORETICAL FRAMEWORK

In this section, a simple monetary model of exchange market pressure is presented to frame the analysis. In the framework of demand and supply for base money, the model clarifies that a change in both international reserves and prices of foreign exchange can affect the foreign exchange market or the pressure on the external position of a country. Girton and Roper (1977) made an important early effort to develop the model. Many empirical studies apply the model, for instance, Weymark (1997) for Canada, Oskooee and Bernstein (1999) for the G-7 countries, Karfakis and Moschos (1999) for Greece, and Pentecost, Poeck, and Hooydonk (2001) for the EU. Recently, Tanner (2001) employed the model to study the effect of monetary policy to exchange market pressure in Asia and Latin America, Gochoco-Bautista and Bautista (2005) for the case of Philippines, and Garcia and Malet (2007) for Argentina. In the literature of dating currency crises, the model is employed to capture the notion of (un)successful attack on exchange rate, see for instance, Eichengreen, Rose, and Wyplosz (1995, 1996) and Lestano and Jacobs (2007).

The monetary model of exchange market pressure presented here is different from Girton and Roper (1977) in a number of respects. Unlike Girton and Roper (1977), we include the interest rate differential between the home country and the reference country since the pressure on exchange market is due partly and frequently to interest rates shocks. Therefore, interest rate differential becomes a weighted part in the construction of *EMP* instead of determinant. The reason is that interest rate differential may be a noisy indicator of monetary policy, since it contains market elements as well, including expected exchange depreciation and a risk premium. For money demand model, we take a general specification. Different specifications have been used by others, for example, Girton and Roper (1977) assume an exponential money demand function and Pentecost, Poeck, and Hooydonk (2001) and Oskooee and Bernstein (1999) adopt log-linear models. We use more realistic assumption on money multiplier of money supply, i.e. as a portion of net foreign assets and domestic credit rather than to assume a constant money multiplier equal to unity like Girton and Roper (1977), Pentecost, Poeck, and Hooydonk (2001), and Garcia and Malet (2007).

Exchange rate market pressure is derived from a model of equilibrium in the money market. Consider the following specification of the demand for base money. Domestic money demand is determined by the level of real income (Y), price level (P), wealth of non-bank private sector (W), and interest rates. Following Fase and Winder (1993) and Pentecost, Poeck, and Hooydonk (2001), there are three kinds of interest rates, that is a short-term rate for money balances (B), and the returns on domestic and foreign long-term assets, i and i^f , respectively. The latter interest rates relate inversely with money demand. The general demand model for nominal money balances is given by:

$$\dots\dots\dots (1)$$

The supply of base money (M^s) is simply a fraction of net foreign assets or base money backed by foreign reserves (F) and base money created by domestic credit expansion (D). The base money created against foreign reserves (F) is the sum of the flows of international reserves and consists of which divided into primary assets (R) and foreign exchange (R^e). The supply of nominal base money and the specification of base money created against foreign reserves are determined by the following equations:

$$\dots\dots\dots (2)$$

$$\dots\dots\dots (3)$$

where m is the money multiplier and E and R denote the currency values of R and R^e . The dots over the variable indicate \dot{m} and \dot{R} .

The equilibrium condition of money market for a domestic country can be written as follows after substituting equation (3) into (2):

$$\dots\dots\dots (4)$$

Taking the first derivative of the logarithmic version of equation (4) and represented in growth rates, the money market equilibrium becomes:

$$\dots\dots\dots (5)$$

Where

$$\begin{aligned} \varepsilon_p &= \frac{p}{M} \frac{\partial M}{\partial p} ; & \varepsilon_y &= \frac{y}{M} \frac{\partial M}{\partial y} ; & \varepsilon_w &= \frac{w}{M} \frac{\partial M}{\partial w} ; \\ \varepsilon_b &= \frac{b}{M} \frac{\partial M}{\partial b} ; & \varepsilon_i &= \frac{i}{M} \frac{\partial M}{\partial i} ; & \varepsilon_f &= \frac{f}{M} \frac{\partial M}{\partial f} ; \end{aligned}$$

The ε_p , ε_y , ε_w , ε_b , ε_i , and ε_f are the money demand elasticities with respect to price level, income, private non-bank wealth, and returns on money balances, domestic and foreign assets.

Interaction between domestic and foreign countries can be analyzed by assuming that consider a foreign country with the same structure of money market equilibrium as the domestic economy. We subtract the equilibrium condition of foreign country from that of domestic. Let the subscript “ f ” denotes foreign. We can therefore write:

$$\dots\dots\dots (6)$$

The domestic and foreign money markets are linked by means of the purchasing power parity condition or differential inflation rate adjusted for exchange rate changes:

$$\dots\dots\dots (7)$$

Where e_t and e_t^* . The e_t is nominal exchange rate, and e_t^* is real exchange rate and also as a measure of the deviation from purchasing power parity. The nominal exchange rate (e) is defined as the number of units of foreign currency per unit of domestic currency. Therefore, a decrease in e represents either a depreciation or a devaluation. Regrouping the terms in equation (6), and replacing by equation (7), we obtain:

$$\dots(8)$$

The expression on the left hand side of the equation (8) is a measure of the exchange market pressure (*EMP*) in both domestic and foreign country, as observed in the changes of the nominal exchange rate, of interest rate differentials and of foreign reserves differentials. Under a fixed exchange rate regime, $e_t = 0$ and with freely floating exchange rates, $r_t = 0$. This equation are well-known in the literature of currency crisis for defining and predicting currency crisis events, see for example, Eichengreen, Rose, and Wyplosz (1995, 1996), Kaminsky and Reinhart (1999), Lestano and Jacobs (2007), and Jacobs, Kuper, and Lestano (2008). Pressure on exchange rate market may due to speculative attacks. Successful speculative attacks push exchange rate pressure up indicated by exchange rate depreciation. Authorities can also intervene in the foreign exchange market to defend their currencies from attacks. The intervention involves either losing international reserves or raising domestic short-term interest rates.

Rates of change of domestic and foreign output and credit, returns on long-term asset differentials, money multiplier differentials, wealth of non-bank sector, and real exchange rate are triggering determinants of the exchange market pressure reflected in devaluations and speculative attacks. As expected by the model, domestic growth money multiplier, domestic credit growth, and deviation from the purchasing power parity rule are related positively with *EMP*. Higher values of these variables may escalate *EMP*. The rest of domestic variables are associated negatively with *EMP*.

3. MODEL OF RESEARCH

In the previous section, we discussed a theoretical model of exchange market pressure (*EMP*). The core features of the model are the movements of *EMP* could be affected by financial and real variables. Our interest with the *EMP* model focuses on the interactions between not only *EMP* and monetary policy, but between *EMP*, monetary policy, and economic growth. Many studies, such as Tanner (2001) and Gochoco-Bautista and Bautista (2005) emphasize on the link between *EMP* and monetary policy. We follow Garcia and Malet (2007) by linking the two variables with economic growth.

To our purpose, a monetary policy stance is measured by d_t (growth of domestic credit), the portion of the monetary base controlled by domestic policy makers. According to our theoretical model and the monetary transmission mechanism, an increase in the interest rate in the country under study would induce an increase in the exchange market pressure, both directly—as indicated by equation (8)—and indirectly, via a decrease in output. Concerning the effect of domestic credit growth on *EMP*, our model indicates that a restrictive credit policy will decrease market pressure against the domestic currency. On the other hand, if a decline in domestic credit growth brings about a slowdown of growth, this may in turn provoke an increase in *EMP*.

In this section we derive an empirical model from the theoretical one described above. We use a Vector AutoRegression (VAR) model in order to avoid the imposition of ‘incredible’ assumptions. The key step in VAR modeling is the identification of shocks. This is usually done by appealing to informational orderings about the arrival of shocks. Various identification strategies have been proposed in the literature, advocating short-run restrictions (Bernanke, 1986; Blanchard and Watson, 1986; Sims, 1986), or long-run restrictions (Blanchard and Quah, 1989), or combinations of short-run and long-run restrictions (Gali, 1992) on impulse responses that are derived from economic theory. No matter what identification strategy is used, all methods should be applied with caution (Fry and Pagan, 2005). Since apparently there is model identification uncertainty, we implement Bernanke (1986) type of short-run contemporaneous restrictions to identify the structural shocks in the model. This approach subsequently addresses short-run nature of the link of *EMP*, monetary policy, and economic growth. So, we pursue the following modeling strategy: we identify the SVAR-model using the theoretical prescriptions on the initial short-run propagation of shocks.

We specify the following form of a Structural Vector AutoRegression (SVAR) model. We estimate the reduced form:

$$\dots\dots\dots (9)$$

where y_t is a k -vector of endogenous variables, x_t a vector of exogenous variables, $B(L)$ and $D(L)$ are matrix polynomials in the lag operator L , and u_t are the reduced-form residuals with variance-covariance matrix $\Sigma = E_t [u_t u_t']$. The autoregressive matrix

polynomial is defined as:

where I_k is $k \times k$ identity matrix and p is the maximum lag. We assume that the economy can be described by a structural form:

$$\dots\dots\dots (10)$$

where ε_t are serially uncorrelated (with orthonormal variance-covariance matrix Σ). Structural disturbances and reduced form residuals are related by $\dots\dots\dots$. This implies that:

$$\dots\dots\dots (11)$$

The G_0 is the $(k \times k)$ matrix that describes the relation between the structural shocks and the reduced-form residuals. Next we discuss how we implement this G_0 -matrix. As is well-known we need at least $k(k-1)/2$ additional restrictions (e.g., on top of normalization with ones on the diagonal) on the parameters of G_0 to achieve exact identification. In a SVAR economic theory is used to derive restrictions on the G_0 matrix.

The theoretical model of exchange market pressure given above directs us to the following list of variables: domestic real output growth rate (y_t) growth rates of domestic credit (d_t), change in domestic money multiplier (a_t) and exchange rate market pressure (EMP_t). All foreign variables: output growth rate (y_t^f) growth rates of foreign credit (d_t^f) change in foreign money multiplier (a_t^f) will be considered exogenous to the VAR, and so will the deviation from the purchasing power parity rule (θ_t) given that they are all determined outside the domestic system and that domestic economy consider as a "small" country, cannot influence them. Note that we skip returns on long-term asset and wealth of non-bank sector, which is typically hard to get.

The composition of the G_0 -matrix with elements β_{ij} are as follows. The most important restriction is that domestic real output growth rate are set as the most exogenous of all the variables in the VAR. So we put the domestic real output growth rate on top of the ordering of variables without a feedback. Domestic real output growth rate responds only to idiosyncratic shocks:

$$\dots\dots\dots (12)$$

The shocks to the domestic credit depend on the structural shocks to the domestic credit itself and the domestic real output growth:

$$\dots\dots\dots (13)$$

Domestic money multiplier is assumed to be determined by shocks to the domestic real output growth, the domestic real output growth, and the own shocks:

$$\dots\dots\dots (14)$$

We assume that *EMP* responds to shocks in the real output, the domestic credit, the money multiplier, price level, the domestic interest rate, the exchange rate, and the own shocks:

$$\dots\dots\dots (15)$$

In nutshell, we model 4-dimensional VAR with all foreign variables and the deviation from the purchasing power parity rule as exogenous variables. Equations (12) to (15) can be summarize in the $u_t = G_0^{-1} \varepsilon_t$ as follows:

Note that the structural model is just-identified.

Data Sources and Properties

We choose to investigate the particular case of Indonesia. The SVAR model developed in Section 3 is used to reveal the impact of financial and real sector shocks on the exchange rate market pressure of the country. We use quarterly data from 1981:Q1 to 2004:Q4 — that is, during much of the convertibility plan—especially during the period of Asian financial crisis 1997-1998—and several years after its collapse. The time span is selected according to data availability for the relevant series. We use US as foreign economy for which the country is selected with a strong currency that serves as an anchor to Indonesia. All data is obtained from the International Financial Statistics-IMF. Table 1 gives a review of the series used in the SVAR model and their transformations. All data in local currency units are converted into US dollars.

Table 1
SVAR model variables: definitions and transformations

Variables	Definition	Unit	Transformation and source
y, y^f	Real GDP	Index (2000=100)	First difference of the logs. IFS line 99B for Indonesia and IFS line 66 for US.
d, d^f	Domestic credit	Billions (national currency). Converted into US dollars	First difference of the logs. IFS line 32.
a, a^f	Money multiplier	--	Domestic credit (IFS line 32) plus international reserve (IFS line 1L.D) divided by base money (IFS line 34). First difference of the logs.

θ	Deviation from the purchasing power parity rule	--	Growth of exchange rate (IFS line AE) minus inflation rate differential. Inflation rate is defined as first difference of the logs of consumer price index ((IFS line 64).
EMP	Exchange market pressure index	--	Growth of exchange rate (IFS line AE) plus interest rate (IFS line 60B) differential minus international reserves (IFS line 1L.D) differential.
b, b^f	Short-term interest rate	Percentage	First difference of the logs. IFS line 60B.
p, p^f	Consumer price index	Index (2000=100)	First difference of the logs. IFS line 64.
e	Exchange rate	National currency per US dollar	First difference of the logs. IFS line AE.
r, r^f	International reserve	Billions (US dollar)	First difference of the logs. IFS line 1L.D.
M^s	Money supply	Billions (national currency). Converted into US dollars	IFS line 34.

Note : Superscript “ f ” denotes US and without superscript denotes Indonesia. IFS denote International Financial Statistics of the IMF.

Table 2 shows unit root test outcomes on the variables used and clustered into endogenous and exogenous variables. In general all level series are of order $I(0)$. This should not come as a complete surprise considering the fact that all variables in growth rate transformation. So, we can escape the trade-off issues between using a VAR model of $I(0)$ or employing a VECM (Vector Error-Correction Model) model. We proceed to employ the latter VAR model.

Table 2
Augmented Dickey-Fuller test results, 1981:Q1-2004:Q4

Endogenous variables	no. trend	Trend	Exogenous variables	no. trend	Trend
y	-4.30(1)	-4.28(1)	y^f	-3.39(5)	-3.26(5)
a	-3.21(4)	-3.86(4)	a^f	-3.59(4)	-3.58(4)
d	-3.48(4)	-3.61(4)	d^f	-3.60(0)	-3.57(0)
EMP	-4.86(1)	-4.89(1)	θ	-5.58(1)	-5.56(1)

Note : The number of lags for the unit root tests is based on Schwartz Information Criterion. At the 5% level, the ADF test critical values with trend and without trend for individual countries are -3.46 and -2.89, respectively. The numbers within parentheses exhibit the order of lag(s). Superscript “ f ” denotes US and without superscript denotes Indonesia.

4. ANALYSIS AND DISCUSSION

In this section, we present the results of the identified VAR model outlined in the Section 3. We estimate the identified VAR-models for Indonesia with the sample of 96 quarters (1980:Q1–2004:Q4). Endogenous variables in the SVAR models are all Indonesia variables, that are real income growth (y), domestic credit growth (d), growth of money multiplier (a), and *EMP*. Exogenous variables are deviation from the purchasing power parity (θ) and all US variables, that are, y^f , d^f , and a^f . Real output and prices are seasonally adjusted and complete seasonal dummies as well as an intercept and a time trend are used in estimation. We take 4 lags using quarterly data and apply the structural factorization as set out in the Section 3. Optimal endogenous lags chosen by Aikake Information Criterion, Hannan-Quinn Criterion, and Schwarz Criterion direct us to 10, 10, and 4 lags, respectively. Bearing in mind that we have a short-time time series and hence we could run the risk of over-parameterization, we employ 4 lags as suggested by the Schwarz Criterion. The structural factorization embeds just-identified, so test for the validity of the over-identifying restrictions is dispensable.

The standard practice to compute impulse responses is to shock the system with a one standard deviation shock computed from the VAR innovations. Figure 1, 2, and 3 show impulse response functions of standardized shocks in real income, domestic credit, and money multiplier, respectively. The two dashed lines in each figure depict the 95% confidence bands calculated using bootstrap confidence interval of Hall's percentile interval. Hall (1992) provides a detailed exposition of Hall's bootstrap confidence interval. Given the assumption that the shocks are instantaneously uncorrelated, the corresponding impulse responses are referred to as orthogonalized impulse responses. The impulse responses are plotted over a 20 quarters horizon.

Figure 1 shows that the general pattern of an domestic credit shock is the following. The impulse response function (IRF) shows that there is a positive and contemporaneous effect of domestic credit on *EMP* in the first three quarters. Our IRF results are similar to those in Tanner (2001), Gochoco-Bautista and Bautista (2005), and Garcia and Malet (2007) : a shock to domestic credit implies a significant and positive response of *EMP*. This result is supportive to our model: an expansionary shock to monetary policy, as defined, either reduces international reserves, causes the currency to depreciate, or some combination thereof. In spite of the positive effect of domestic credit growth on *EMP* depicted in the IRF, in Indonesia case it cannot be said that the monetary transmission could not compensate for the mechanism described in our model. As we shall see, Indonesia presented the peculiarity where a credit expansion is harmful to output growth (cf. Lestano and Sterken, 2006). Hence, an “inverse” monetary transmission mechanism actually reinforced—instead of compensating for—the positive effect of domestic credit on exchange market pressure.

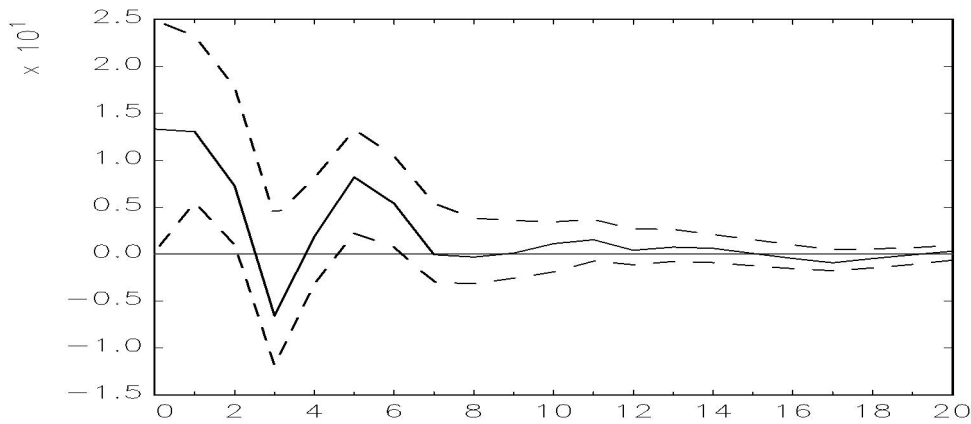


Figure 1. Response of *EMP* to domestic credit growth shock with 95% Hall bootstrap confidence interval using 2,000 bootstrap replications.

Shocks to the real output growth variable are important for explaining *EMP* as shown in Figure 2. The IRF suggest that shocks to real output growth affect *EMP* negatively, thus confirming the relationships portrayed in our theoretical model. However, it is also true that a positive relationship appears after two quarters. This result reinforces that worsening in the fundamental variables, like output growth, play a role in heightening pressure on exchange rate market. Figure 3 depicts the money multiplier shocks affect *EMP* negatively in two quarters, but positively in latter periods (consistent with our theoretical model). Money multiplier shocks are much more reflected in the behavior of international reserves, domestic credit, and money supply. Domestic credit expansion, resulted from expansionary monetary policy, may escalate *EMP*.

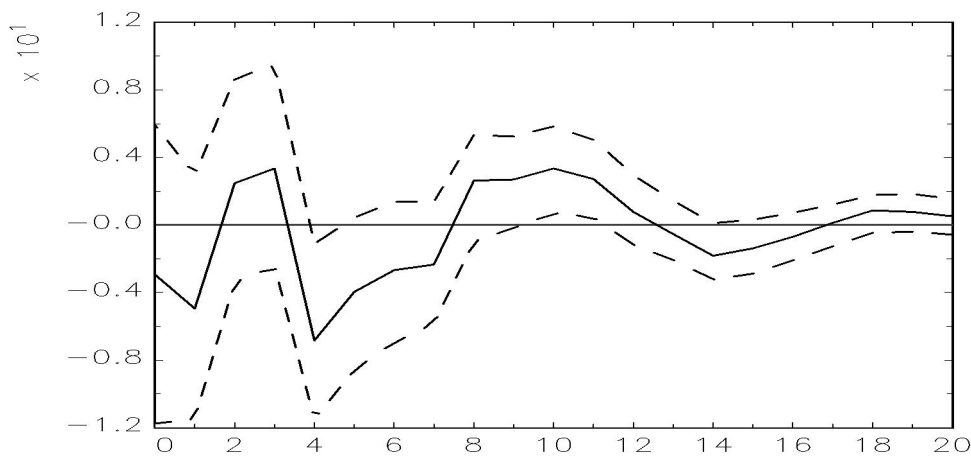


Figure 2. Response of *EMP* to output growth shock with 95% Hall bootstrap confidence interval using 2,000 bootstrap replications.

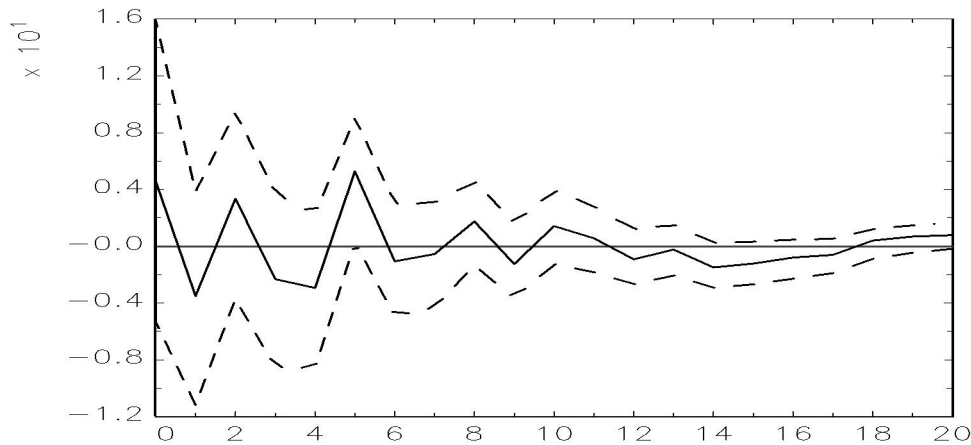


Figure 3. Response of *EMP* to money multiplier shock with 95% Hall bootstrap confidence interval using 2,000 bootstrap replications.

6. CONCLUSION

Starting from a monetary model, we have derived a modified version of exchange rate market pressure model. The model relates the level of exchange market pressure to stance of monetary policy and real sector. We examined the relationship for the case of Indonesia using a SVAR technique over the periods 1981-2004. In general, the study finds that expansionary monetary policy (high domestic credit growth) and worsening the real sector does reduce *EMP* in accordance with theory. In some periods, money multiplier as another measure of monetary policy affects *EMP* in line with domestic credit growth shock to *EMP*.

Our findings have the following implications for monetary policy. Since there is an obvious link *EMP*, monetary policy, and the real sector, the empirical results in this study can be seen as supporting the case for signaling heightening exchange rate market pressure as results of expansionary monetary policy and recession. Signs of the incapability of monetary authorities to control money supply may signal high pressure on exchange rate market. In addition, weak supervision of domestic credit management may intensify exchange rate market pressure, which in turns induces bank runs and capital flight.

REFERENCES

- Bernanke, B.S. (1986), "Alternative explanations of the money-income correlation", *Carnegie-Rochester Series on Public Policy*, 25, 49–99.
- Blanchard, O.J. and D. Quah (1989), "The dynamic affects of aggregate demand and supply disturbances", *American Economic Review*, 79, 655–673.
- Blanchard, O.J. and M.W. Watson (1986), "Are business cycles all alike? (with discussion)", in R.J. Gordon, editor, *The American Business Cycle*, University of Chicago Press, Chicago, 123–179.
- Eichengreen, B., A.K. Rose, and C. Wyplosz (1995), "Exchange rate mayhem: the antecedents and aftermath of speculative attacks", *Economic Policy*, 21, 251–312.
- Eichengreen, B., A.K. Rose, and C. Wyplosz (1996), "Contagious currency crises: first tests", *Scandinavian Journal of Economics*, 98(4), 463–484.
- Fase, M.M.G and C. Winder (1993), "The demand for money in the Netherlands and the other EC countries", *De Economist*, 141(14), 471–496.
- Fry, R. and A. Pagan (2005), "Some issues in using VARs for macroeconomic research", *CAMA Working Paper* 18/2005, Centre for Applied Macroeconomic Analysis, The Australian National University, Canberra.
- Garcia, C. and N. Malet (2007), "Exchange market pressure, monetary policy, and economic growth: Argentina", 1993-2004, *The Developing Economies*, XLV(3), 253-282.
- Gali, J. (1992), "How well does the IS-LM model fit the postwar U.S. data?", *Quarterly Journal of Economics*, 107, 709–738.
- Girton, L. and D. Roper (1977), "A Monetary Model of Exchange Market Pressure applied to the postwar Canadian experience", *American Economic Review*, 67(4), 537-548.
- Gochoco-Bautista, M.S., and C.C. Bautista (2005). "Monetary policy and exchange market pressure: the case of the Philippines" *Journal of Macroeconomics*, 27(1), 153–68.
- Hall, P. (1992). *The Bootstrap and Edgeworth Expansion*, Springer, New York.
- Jacobs, J.P.A.M., G.H. Kuper, and Lestano (2008). Currency crises in Asia: a multivariate logit approach, in S.J. Kim and M. McKenzie (eds), *Asia-Pacific Financial Markets: integration, innovation, and challenges*, International Finance Review, Elsevier, 8, 157-173.
- Kaminsky, G.L. and C.M. Reinhart (1999), "The twin crises: the causes of banking and balance-of-payments problems", *American Economic Review*, 89(3), 473–500.

- Karfakis, C. and D. Moschos (1999). "Searching for indicators of foreign exchange market pressure: evidence from Greece", *International Journal of Finance and Economics*, 4, 63–73.
- Lestano and E. Sterken (2006). "A structural VAR of currency crisis economies under credit constraints", *Mimeo*, Department of Economics, University of Groningen, The Netherlands.
- Lestano and J.P.A.M. Jacobs (2007), "Dating currency crises with *ad hoc* and extreme value based thresholds: East Asia 1970-2002", *International Journal of Finance and Economics*, 12(4), 371-388.
- Oskooee, M.B. and D.J. Bernstein (1999), "Exchange rate market pressure during the current managed float", *Applied Economics Letters*, 6(9), 585-588.
- Pentecost, E.J., A. van Poeck, and C. van Hooydonk (2001), "Measuring and estimating exchange market pressure in the EU", *Journal of International Money and Finance*, 20(3), 401-418.
- Sims, C.A. (1986), "Are forecasting models usable for policy analysis?", *Federal Reserve Bank of Minneapolis Quarterly Review*, 10, 1–16.
- Tanner, E. (2001), "Exchange rate market pressure and monetary policy: Asia and Latin America in the 1990s", *IMF Staff Papers* 47/3, International Monetary Fund, Washington, D.C.
- Weymark, D.N. (1997), "Measuring the degree of market exchange intervention in a small open economy", *Journal of International Money and Finance*, 16(1), 55–79.